IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: M. HANNUKSELA

Serial No.: To be Assigned

Filed: Herewith

For: VIDEO CODING

PRELIMINARY AMENDMENT

Assistant Commissioner of Patents
Washington, D.C. 20231

Sir:

Prior to examination, please amend this application as follows:

IN THE SPECIFICATION

Please replace the heading Background of the Invention on page 1 with the following rewritten heading:

--BACKGROUND OF THE INVENTION--.

Please insert the following heading after line 5 on page 1:

--Description of the Prior Art--.

Please replace the paragraph beginning at page 2, line 6, with the following rewritten paragraph:

--Many video compression schemes also use temporally bi-directionally predicted frames, which are commonly referred to as B-pictures or B frames. B-pictures are inserted

between anchor picture pairs of I- and/or P-frames and are predicted from either one or both of these anchor pictures. B-pictures normally yield increased compression compared with forward-predicted pictures. B-pictures are not used as anchor pictures, i.e., other pictures are not predicted from them. Therefore they can be discarded (intentionally or unintentionally) without impacting the picture quality of future pictures. While B-pictures may improve compression performance as compared with P-pictures, their generation requires greater computational complexity and memory usage, and they introduce additional delays. This may not be a problem for non-real time applications such as video streaming but may cause problems in real-time applications such as video-conferencing.--

Please replace the paragraph beginning at page 4, line 21, with the following rewritten paragraph:

--Current video coding standards define a syntax for a self-sufficient video bit-stream. The most popular standards at the time of writing are ITU-T Recommendation H.263, "Video Coding for Low Bit Rate Communication", February 1998; ISO/IEC 14496-2, "Generic Coding of Audio-Visual Objects. Part 2: Visual", 1999 (known as MPEG-4); and ITU-T Recommendation H.262 (ISO/IEC 13818-2) (known as MPEG-2). These standards define a syntax for bit-streams and correspondingly for image sequences and images.

Please replace the heading Summary of the Invention on page 6 with the following rewritten heading:

--SUMMARY OF THE INVENTION--.

Please replace the heading Brief description of the drawings on page 8 with the

following rewritten heading:

--BRIEF DESCRIPTION OF THE DRAWINGS --.

Please replace the heading Detailed description of the invention on page 8 with the following rewritten heading:

--DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION --.

Please replace the paragraph beginning at page 9, line 30, with the following rewritten paragraph:

--The decoder part 200 of the video codec 10 comprises an inverse quantiser 220, an inverse DCT transformer 221, a motion compensator 222, a plurality of picture stores 223 and a control 224. The control 224 receives video codec control signals demultiplexed from the encoded multimedia stream by the demultiplexer 50. In practice the control 105 of the encoder and the control 224 of the decoder may be the same processor.--

Please replace the paragraph beginning at page 15, line 11, with the following rewritten paragraph:

--Consider the pictures shown in Figure 5, transmitted in the following order: 10, P1, P2, P3, I4, P4, P0, P5...etc. The decoder receives picture 10 (501) and determines (602) from its picture header that the picture is INTRA-coded. The decoder decodes picture 10 (608) without reference to any other picture, displays it and stores it in picture store 223a (604). The decoder then receives picture P1 (501) and determines (602) from its picture header that the picture is INTER-coded as a P-picture. The decoder determines whether

picture 1 has already been decoded (605). Since picture 1 has not already been decoded, the decoder checks whether the reference picture for P1 has been received and decoded (606). As picture 0 has been received and decoded, the decoder decodes picture P1 (608) with reference to the reference picture 0, displays it and stores it in the next picture store 223b (604). The decoder then receives picture P2 (501) and determines (602) from its picture header that the picture is INTER-coded as a P-picture. Picture 2 has not been decoded (605) and the reference picture 1 has been decoded (606) so the decoder therefore decodes picture P2 with reference to the preceding reference picture 1, displays it and stores it in the next picture store 223 c and so on. The same procedure (steps 602, 608, 605 and 606) is followed for INTER coded picture P3.--

Please replace the paragraph beginning at page 16, line 1, with the following rewritten paragraph:

--The decoder then receives picture P4 (501) and determines (602) from its picture header that the picture is INTER-coded as a P-picture. However the decoder notes (605) that picture 4 has already been successfully decoded and discards picture P4 and receives the next picture of data P0. The decoder determines (602) from its picture header that the picture is INTER-coded as a P-picture. However the decoder notes (605) that picture 0 has already been decoded, discards picture P0 and subsequently receives the next picture of data P5. This picture is then decoded with reference to decoded picture 4.--

Please replace the paragraph beginning at page 16, line 21, with the following rewritten paragraph:

--When 14 is received successfully, the decoder decodes 14 without reference to any

other frame. When P4 is received it is ignored because picture 4 has already been decoded (605). When P0 is received the decoder determines that picture 0 has not already been decoded (605) and that the reference picture for P0 (picture 4) has been decoded (606). The decoder therefore decodes (608) frame P0 with reference to picture 4. Since picture 0 has now been decoded, it is possible to decode any buffered frames for which picture 0 was the reference picture. Thus the decoder decodes (608) the buffered frame P1 with reference to picture 0. After decoding frame 1, the decoder is also able to decode the buffered frame P2 and, after decoding frame 2, the decoder is also able to decode the buffered frame P3.--

Please replace the paragraph beginning at page 20, line 23, with the following rewritten paragraph:

--The framework of an entire multimedia content creation and retrieval system will now be described with reference to Figure 9. The system has one or more media sources 90, e.g. a camera and a microphone. Multimedia content can be synthetically created e.g. animated computer graphics and digitally generated music. To compose a multimedia clip consisting of different media types, the raw data captured from the sources are edited by an editing system 91. Typically the storage space required for raw multimedia data is huge. To facilitate an attractive multimedia retrieval service over low bit rate channels, multimedia clips are also compressed in the editing system 91. Then the clips are handed to a multimedia server 92. Typically, a number of clients 93 can access the server over a network. The server 92 is able to respond to requests presented by the clients 93. The main task for the server is to transmit a desired multimedia clip to a given client. The client 93 decompresses and plays the clip. In the playback phase, the client utilises one or more output devices 94, e.g. the screen and the loudspeaker of the client. In the system shown in Figure 9, the server incorporates a

video encoder according to the invention and the client incorporates a video decoder according to the invention. In applications involving two-way video transmission, both the server and the clients incorporate video codec according to the invention.--

IN THE CLAIMS

Please amend claim 8 as follows:

8. (Amended) A multimedia system including a video encoder according to claim 6.

Please amend claim 11 as follows:

11. (Amended) A video decoder comprising an input for receiving a signal representing encoded pictures of a video sequence, said video decoder determining whether a non-temporally predicted frame or part thereof has been corrupted, and, if so, monitoring for a temporally-predicted representation of the frame or part thereof and, on receipt of the temporally-predicted representation of the frame or part thereof, decoding the temporally-predicted representation of the frame or part thereof with reference to another frame.

Please amend claim 12 as follows:

12. (Amended) A portable electronic device incorporating a video encoder according to claim 6.

Please insert the following new claims:

--13. A multimedia system including a video codec according to claim 7.

14. A portable electronic device incorporating a video decoder according to claim 11.--

IN THE ABSTRACT

Please replace the Abstract with the following rewritten Abstract:

--A method of encoding a video signal representing a sequence of pictures, the method comprising encoding a first picture (or segment of a picture) of the sequence without reference to another picture of the sequence to produce a picture (10) and encoding said first picture (or segment of a picture) with reference to another picture (14) and the sequence to produce a corresponding temporally predicted picture (P4) or segment of a picture.--

REMARKS

This Preliminary Amendment is filed to remove the multiple dependent claims prior to calculation of the filing fee and to improve the form of the application for examination. Examination on the merits is respectfully requested.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "**Version with markings to show changes made**."

To the extent necessary, Applicant(s) petitions for an extension of time under 37 CFR §1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP Account No. 01-2135 (367.40448X00) and please credit any overpayment of fees to such deposit account.

Respectfully submitted,

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DES/kmh

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification

Please replace the heading [Background of the Invention] on page 1 with the following rewritten heading:

--BACKGROUND OF THE INVENTION--.

Paragraph beginning at page 2, line 6, has been amended as follows:

Many video compression schemes also use temporally bi-directionally predicted frames, which are commonly referred to as B-pictures or B frames. B-pictures are inserted between anchor picture pairs of I- and/or P-frames and are predicted from either one or both of these anchor pictures. B-pictures normally yield increased compression compared with forward-predicted pictures. B-pictures are not used as anchor pictures, i.e., other pictures are not predicted from them. Therefore they can be discarded (intentionally or unintentionally) without impacting the picture quality of future pictures. [Whilst] While B-pictures may improve compression performance as compared with P-pictures, their generation requires greater computational complexity and memory usage, and they introduce additional delays. This may not be a problem for non-real time applications such as video streaming but may cause problems in real-time applications such as video-conferencing.

Paragraph beginning at page 4, line 21 has been amended as follows:

Current video coding standards define a syntax for a self-sufficient video bit-stream. The most popular standards at the time of writing are ITU-T Recommendation H.263, "Video [coding] Coding for [low bit rate communication] Low Bit Rate Communication", February 1998; ISO/IEC 14496-2, "Generic Coding of Audio-Visual Objects. Part 2: Visual", 1999

(known as MPEG-4); and ITU-T Recommendation H.262 (ISO/IEC 13818-2) (known as MPEG-2). These standards define a syntax for bit-streams and correspondingly for image sequences and images.

Please replace the heading [Summary of the Invention] on page 6 with the following rewritten heading:

--SUMMARY OF THE INVENTION--.

Please replace the heading [Brief description of the drawings] on page 8 with the following rewritten heading:

--BRIEF DESCRIPTION OF THE DRAWINGS --.

Please replace the heading [Detailed description of the invention] on page 8 with the following rewritten heading:

--DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION --.

Paragraph beginning at page 9, line 30, has been amended as follows:

The decoder part 200 of the video codec 10 comprises an inverse quantiser 220, an inverse DCT transformer 221, a motion compensator 222, a plurality of picture stores 223 and a [controller] control 224. The [controller] control 224 receives video codec control signals demultiplexed from the encoded multimedia stream by the demultiplexer 50. In practice the [controller] control 105 of the encoder and the [controller] control 224 of the decoder may be the same processor.--

Paragraph beginning at page 15, line 11 has been amended as follows:

Consider the pictures shown in Figure 5, transmitted in the following order: I0, P1, P2, P3, I4, P4, P0, P5...etc. The decoder receives picture I0 [(601)] (501) and determines (602) from its picture header that the picture is INTRA-coded. The decoder decodes picture I0 [(603)] (608) without reference to any other picture, displays it and stores it in picture store 223a (604). The decoder then receives picture P1 [(601)] (501) and determines (602) from its picture header that the picture is INTER-coded as a P-picture. The decoder determines whether picture 1 has already been decoded (605). Since picture 1 has not already been decoded, the decoder checks whether the reference picture for P1 has been received and decoded (606). As picture 0 has been received and decoded, the decoder decodes picture P1 [(603)] (608) with reference to the reference picture 0, displays it and stores it in the next picture store 223b (604). The decoder then receives picture P2 [(601)] (501) and determines (602) from its picture header that the picture is INTER-coded as a P-picture. Picture 2 has not been decoded (605) and the reference picture 1 has been decoded (606) so the decoder therefore decodes picture P2 with reference to the preceding reference picture 1, displays it and stores it in the next picture store 223 c and so on. The same procedure (steps 602, [603] 608, 605 and 606) is followed for INTER coded picture P3.

Paragraph beginning at page 16, has been amended as follows:

The decoder then receives picture P4 [(601)] (501) and determines (602) from its picture header that the picture is INTER-coded as a P-picture. However the decoder notes (605) that picture 4 has already been successfully decoded and discards picture P4 and receives the next picture of data P0. The decoder determines (602) from its picture header

that the picture is INTER-coded as a P-picture. However the decoder notes (605) that picture 0 has already been decoded, discards picture P0 and subsequently receives the next picture of data P5. This picture is then decoded with reference to decoded picture 4.

Paragraph beginning at page 16, line 21, has been amended as follows:

When 14 is received successfully, the decoder decodes 14 without reference to any other frame. When P4 is received it is ignored because picture 4 has already been decoded (605). When P0 is received the decoder determines that picture 0 has not already been decoded (605) and that the reference picture for P0 (picture 4) has been decoded (606). The decoder therefore decodes [(603)] (608) frame P0 with reference to picture 4. Since picture 0 has now been decoded, it is possible to decode any buffered frames for which picture 0 was the reference picture. Thus the decoder decodes (608) the buffered frame P1 with reference to picture 0. After decoding frame 1, the decoder is also able to decode the buffered frame P2 and, after decoding frame 2, the decoder is also able to decode the buffered frame P3.

Paragraph beginning at page 20, line 23, has been amended as follows:

The framework of an entire multimedia content creation and retrieval system will now be described with reference to Figure 9. The system has one or more media sources 90, e.g. a camera and a microphone. Multimedia content can be synthetically created e.g. animated computer graphics and digitally generated music. To compose a multimedia clip consisting of different media types, the raw data captured from the sources are edited by an editing system 91. Typically the storage space required for raw multimedia data is huge. To facilitate an attractive multimedia retrieval service over low bit rate channels, multimedia clips are also compressed in the editing system 91. Then the clips are handed to a multimedia server 92.

Typically, a number of clients 93 can access the server over a network. The server 92 is able to respond to requests presented by the clients 93. The main task for the server is to transmit a desired multimedia clip to a given client. The client 93 decompresses and plays the clip. In the playback phase, the client utilises one or more output devices 94, e.g. the screen and the loudspeaker of the client. In the system shown in Figure 9, [The] the server incorporates a video encoder according to the invention and the client incorporates a video decoder according to the invention. In applications involving two-way video transmission, both the server and the clients incorporate video codec according to the invention.

In the claims:

Claim 8 has been amended as follows:

8. (Amended) A multimedia system including a video encoder according to claim 6 [or a video codec according to claim 7].

Claim 11 has been amended as follows:

11. (Amended) A video decoder comprising an input for receiving a signal representing encoded pictures of a video sequence, said video decoder [being arranged to determine] determining whether a non-temporally predicted frame or part thereof has been corrupted, and, if so, [to monitor] monitoring for a temporally-predicted representation of the frame or part thereof and, on receipt of the temporally-predicted representation of the frame or part thereof, [to decode] decoding the temporally-predicted representation of the frame or part thereof with reference to another frame.

Claim 12 has been amended as follows:

12. (Amended) A portable electronic device incorporating a video encoder [or video decoder as claimed in any] according to claim 6 [or claim 11].

In the Abstract

The Abstract has been amended as follows:

A method of encoding a video signal representing a sequence of pictures, the method comprising encoding a first picture (or segment of a picture) of the sequence without reference to another picture of the sequence to produce a picture (10) and encoding said first picture (or segment of a picture) with reference to another picture (14) and the sequence to produce a corresponding temporally predicted picture (P4) or segment of a picture.

[Fig 5]